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RESEARCH ARTICLE

A STUDY OF CARDIAC MANIFESTATIONS IN PATIENTS WITH HIV/AIDS

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Abstract

Introduction: HIV/AIDS pandemic is evolving as a major public concern. Cardiovascular diseases are common in HIV-positive patients. Many patients without any symptoms or signs were found to have a cardiovascular disease on autopsy. It is expected that the risk of cardiovascular disease will rise in the following years due to the cardiovascular risk profile and increased life expectancy of infected patients. Therefore, diagnosis and therapy of HIV-associated cardiovascular diseases should be part of the evaluation and management of the HIV-positive patient.

Objectives: To find out the frequency of cardiac manifestations on clinical examination, electrocardiography, chest X-ray, and echocardiographic examination. To assess the association of Cardiac abnormality with CD4 Count in patients with HIV/AIDS. To evaluate the association between cardiac abnormalities with types and duration of antiretroviral therapy regimen (ART).

Method: A total of 100 consecutive patients visiting ART OPD and admitted to our institute were examined for signs and symptoms of cardiovascular disease. All patients were evaluated with electrocardiography, chest X-ray, and 2 D echocardiography. CD4 count was measured for all patients using flow cytometry using a BD FACS Count system.

Results: Out of 100 patients, 53% were male and 47% were female. Patients were divided into subgroups with CD4 count <200, 200-349, 350-499, and ≥500. The mean CD4 count was 403.62 ± 284.98 . Prevalence of the cardiovascular abnormality on ECG, chest X-ray, and echocardiography were 74%, 10%, and 51% respectively. The left ventricular systolic dysfunction was the most common finding in our study with fractional shortening $\leq 25\%$ in 34% of patients and LVEF <50% in 27% of patients followed by left ventricular diastolic dysfunction (26%), dilated cardiomyopathy (6%), pulmonary hypertension (4%), and regional wall motion abnormality (2%). Reduced LV ejection fraction (<50%) and left ventricular diastolic dysfunction were statistically significant in patients with CD4 count less than 200/mm³.

Conclusion: In present study electrocardiographic, chest X-ray and echocardiographic abnormalities were present in 74%, 10% and 51% patients respectively. Cardiac abnormalities such as QTc prolongation,

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LBBB, reduced left ventricular ejection fraction, and left ventricular diastolic dysfunction were more significantly higher in patients with CD4 count less than 200/mm³. We could not find any statistically significant difference in cardiac abnormalities in patients on different ART regimens. Further studies are required with a higher sample size.

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Introduction:-

The acquired immunodeficiency syndrome (AIDS) was first recognized in the United States in 1981. Since then, AIDS/ Human immunodeficiency virus (HIV) infection is evolved as a global pandemic with major public concern. Since the start of the epidemic, 75.7 million [55.9 million–100 million] people have become infected with HIV. 38.0 million [31.6 million–44.5 million] people globally were living with HIV in 2019. 690 000 [500 000–970 000] people died from AIDS-related illnesses in 2019. 25.4 million [24.5 million–25.6 million] people were accessing antiretroviral therapy in 2019. (1) In India, 2.1 million people were living with HIV in 2017 (2).

It was recognized since the start of the AIDS epidemic, first at autopsy and later by non-invasive techniques, that HIV infection can cause cardiac abnormalities. As the epidemic progresses and new treatments help increase the long-term survival of affected individuals, cardiovascular diseases will become more common. Cardiovascular diseases in HIV-positive patients can be due to the virus itself or opportunistic infections due to an immunocompromised state. With aging, traditional risk factors of ischaemic heart diseases have increased in HIV-positive patients. Metabolic side effects of protease inhibitors, zidovudine-induced cardiomyopathy, nutritional deficiencies, immune activation, and proinflammatory cytokines also play a critical role in cardiovascular diseases in HIV-positive patients.

Cardiovascular diseases have increasingly become a leading cause of morbidity and mortality in people living with HIV infection (PLHIV). (3) The prevalence of the cardiac disease in HIV-infected individuals is not clear (28%-73%) (4). The spectrum of disease is broad and includes pericardial effusion, myocarditis, dilated cardiomyopathy, endocarditis, coronary artery disease, pulmonary hypertension, vasculitis, aneurysm formation, and cardiac tumors. (5)

Materials and Methods:-

This hospital-based cross-sectional study was conducted in a tertiary hospital in central India between January 2019 to September 2020. A total of 100 consecutive HIV-positive patients ≥ 18 years of age and visiting ART OPD/ admitted in our hospital were included in this study. Patients with preexisting IHD, congenital heart disease, hypertension, rheumatic heart disease, diabetes mellitus, chronic kidney diseases, thyroid dysfunction, chronic obstructive pulmonary disease, and pregnancy were excluded from the study. A valid informal and written consent was taken from patients.

A detailed history, general physical examination, and systemic examination were done for each patient with special emphasis on the cardiovascular system. History with special reference to duration and type of ART regimen was taken. National AIDS control organization recommended guidelines and ELISA kits were used for diagnosis of HIV patients. CD4 count was measured for all patients using flowcytometry using a BD FACS Count system.

A standard 12 lead ECG examination was performed during quiet respiration in a supine position using a portable Schiller's Cardiovit ECG recorder (Schiller Americas Inc., Doral, Florida, USA). The chest X-ray was taken for each patient in posteroanterior view. It was analyzed for right and left ventricular enlargement, signs of left ventricular failure, pulmonary hypertension, pericardial effusion, and pleural effusion. All patients were subjected to resting two-dimensional transthoracic echocardiography (Esaote 2 D Echo and color doppler machine) in the department of medicine of a tertiary care hospital by cardiologists. Left ventricular dimensions were measured by M-mode in parasternal long-axis view. Left ventricular ejection fraction (LVEF) was measured by the modified Quinones method. LVEF less than 50% and FS $\leq 25\%$ were considered abnormal. Dilated Cardiomyopathy was defined in the presence of left ventricular ejection fraction (LVEF) $< 45\%$ and left ventricular end-diastolic diameter (LVED) $> 112\%$ predicted value corrected for age and body surface area. (6) Left ventricular diastolic dysfunction was diagnosed according to 2009 ASE guidelines. (7) Left ventricular diastolic dysfunction was further graded as

grade I, grade II, and grade III. Systolic pulmonary arterial pressure (SPAP) was estimated using TR jet velocity by the Bernoulli equation. Pulmonary hypertension was defined as SPAP >36 mmHg. Infective endocarditis was diagnosed using modified Dukes criteria. The persistence of an echo-free space between the epicardium and parietal pericardium throughout the cardiac cycle was referred to as pericardial effusion. The statistical analysis was done using Statistical Package for Social Sciences (SPSS) Version 21.0 statistical analysis software. The presentation of the Categorical variables was done in the form of number and percentage (%). On the other hand, the presentation of the continuous variables was done as mean \pm SD and median values. The association of the variables which were qualitative in nature was analyzed using the Chi-Square test/Fisher's Exact test.

Results and Observations:-

One hundred patients were enrolled in our study after taking consent. The mean age of patients was 40.86 ± 11.9 years. 53% of patients were female and 47% of patients were male. 67% of patients were on the Tenofovir-based regimen and 33% of patients were on the zidovudine-based regimen. Patients were receiving ART for a mean duration of 7.29 ± 3.17 years.

In this study, 75% of patients were asymptomatic and 25% were symptomatic. Breathlessness was the most common symptom and it was complained of by 13% of patients followed by chest pain (7%), fever (6%), edema feet (4%), palpitations (3%), nocturnal cough (3%), and paroxysmal nocturnal dyspnoea (2%). None of the patients had syncope. 20% of patients had tachycardia followed by ankle edema (6%), parasternal heave (5%), bradycardia (2%), loud P2 (2%), and muffled heart sounds (1%).

CD4 count (per mm^3) ≥ 500 was present in 29% patients followed by <200 in 28% patients, 200-349 in 25% patients, and 350-499 in 18% patients. The mean value of the CD4 count of study subjects was 403.62 ± 284.98 per mm^3 .

Mean value of ejection fraction(%), fractional shortening (%), EPSS (mm), left atrial size (mm), right atrial size (mm), E/A ratio, deceleration time (msec), TAPSE (mm), IVC size (mm), E/e' and LA volume index (ml/m^2) of study subjects was 55.85 ± 9.24 , 28.25 ± 6.05 , 6.58 ± 1.79 , 26.55 ± 3.82 , 24.52 ± 3.58 , 1.09 ± 0.06 , 171.25 ± 27.87 , 20.21 ± 3.35 , 9.41 ± 2.69 , 8.49 ± 3.88 and 29.51 ± 5.57 respectively.

Cardiac abnormality on electrocardiography, chest X-ray, and echocardiography was present in 74%, 10%, and 51% of patients respectively. QTc prolongation was observed in 35% of patients followed by T inversion in 29% patients, left axis deviation in 21% of patients, sinus tachycardia in 20% of patients, poor progression of r wave in 11% of patients, low voltage complexes in 6% of patients, right axis deviation in 6% of patients, LBBB in 3% of patients, sinus bradycardia in 2% of patients, PR interval shortening in 2% of patients and RBBB in 1% of patients.

Cardiomegaly on chest X-ray was seen in 6% of patients; 2% with left ventricular cardiomegaly and 4% with right ventricular cardiomegaly. Pulmonary hypertension was present in 4% of patients.

Left ventricular systolic dysfunction as measured by fractional shortening $\leq 25\%$ was the most common finding and was present in 34% of patients followed by LVEF $<50\%$ in 27% of patients, left ventricular diastolic dysfunction in 26% of patients, dilated cardiomyopathy in 6% of patients, pulmonary hypertension in 4% of patients, and regional wall motion abnormality in 2% of patients. Pericardial effusion and infective endocarditis were seen in only 1 out of 100 patients (1%) each. Out of 26 patients with diastolic dysfunction, grade 2 and 3 diastolic dysfunction was present in 46.15% of patients each. The grade of diastolic dysfunction was 1 in only 2 out of 26 patients (7.69%).

As compared to groups with CD4 count (per mm^3) 200- 349, 350-499, and ≥ 500 , cardiac abnormality on echocardiography was more common in the group with CD4 count <200 per mm^3 , and this difference was statistically significant. There was a statistically significant association between reduced LVEF and left ventricular diastolic dysfunction with CD4 count less than $200/\text{mm}^3$. There was no statistically significant association between ECG abnormalities and CD4 count except QTc prolongation and LBBB which were significantly higher in patients with CD4 count $<200/\text{mm}^3$.

On comparing echocardiographic abnormalities with tenofovir-based and zidovudine-based ART regimens, no significant difference was observed between the two groups. QTc prolongation and T inversion were significantly higher in patients on the Zidovudine-based regimen as compared to patients with the tenofovir-based regimen. Cardiac abnormalities were comparable in both symptomatic and asymptomatic groups. There was no statistically

significant association of ECG and echocardiographic abnormalities with the duration of ART (≤ 5 years, 6-10 years, and >10 years).

Discussion:-

Our study included 100 consecutive HIV-positive patients diagnosed as per NACO guidelines. The mean age of patients in our study was 40.86 ± 11.9 years and the maximum number of patients belonged to the age group 40-49 years. In a study conducted by Sharma RK et al. mean age of patients was 41.37 years and the maximum number of patients belonged to the age group 41-50 years which is comparable to our study. (8) Kumar P et al. estimated that the mean age of the HIV-positive patients in India will be 43.3 years by the year 2020 which is also comparable to our study. (9) Sixty-seven percent of patients in our study were receiving the Tenofovir-based regimen while 33% of patients were receiving the Zidovudine-based regimen. Similarly, in a study conducted by S Bajaj et al, 62.14% of patients were on the TLE regimen and 37.86% of patients were on the ZLN regimen. (10) Breathlessness was the most common complaint of patients (13%) in our study. R. B. Sudagar Singh et al. also observed breathlessness as the most common symptom in his study. (11)

We evaluated HIV-positive patients with ECG, chest X-ray, and echocardiography. Cardiac abnormality on electrocardiography, chest X-ray, and echocardiography was present in 74%, 10%, and 51% of patients respectively. Mishra TK et al. found the cardiac abnormality on ECG, chest X-ray, and echocardiography in 54.2%, 8%, and 52% of patients respectively. Chaudhary S et al. observed ECG, chest X-ray, and echocardiographic abnormality in 49.3%, 11%, and 52.1% of patients respectively. (12) Okoye IC et al observed ECG abnormalities in 70% of patients which was similar to our study. (13) QTc prolongation (35%) was the most common finding in our study followed by T inversion (29%). Sinus tachycardia was present in 20% of patients in our study. In a study performed by Okoye IC et al, sinus tachycardia (64%) was the most common ECG finding followed by QTc prolongation (48%). (13) We observed a statistically significant association of QTc prolongation and LBBB with CD4 count less than $200 \text{ per } \text{mm}^3$. In our study, cardiac abnormalities on chest X-ray were present in 10% of patients. Cardiomegaly (6%) was the most frequent finding in our study followed by pulmonary artery hypertension (4%). Right ventricular cardiomegaly was present in 4% of patients and left ventricular cardiomegaly was present in 2% of patients. In a study performed by Mishra TK et al. and Chaudhary S et al, cardiomegaly was present in 8% of patients which was similar to our study. (12,14)

In our study, overall echocardiographic abnormalities were significantly common in HIV patients with CD4 count less than $200/\text{mm}^3$ ($p = 0.001$). Similarly, Kumar SKK et al observed statistically significant echocardiographic abnormalities in HIV patients with CD4 count less than $200/\text{mm}^3$ ($p < 0.01$). He observed echocardiographic abnormality in 74.30% of patients with CD4 count less than $200/\text{mm}^3$ compared to 82.14% of patients in the present study. (15)

Left Ventricular Diastolic Dysfunction

Left ventricular diastolic dysfunction was present in 26% of patients in our study as compared to 39% of patients in the study done by Mishra TK et al.(14) Maurya SK et al observed left ventricular diastolic dysfunction in as much as 47% of patients compared to 5% in a study done by Sharma RK et al.(8,16) This suggests wide variations in presence of left ventricular diastolic dysfunction in patients with HIV infection. In our study, LVDD was statistically significant in CD4 count less than $200/\text{mm}^3$. Similarly, Tuteja V et al and Mishra TK et al observed statistically significant LVDD in patients with CD4 count less than $200/\text{mm}^3$.(14,17)

In our study, left ventricular diastolic dysfunction was graded as grade I (mild), grade II (moderate), and grade III (severe) according to recent guidelines given by the American Society of Echocardiography. We observed grade I diastolic dysfunction in 2% of patients, grade II and grade III diastolic dysfunction in 12% of patients each. Mankwe et al observed similar findings as our study with mild diastolic dysfunction in 2% patients, moderate diastolic dysfunction in 22% of patients, and severe diastolic dysfunction in 16% of patients. (18) Jain N et al observed grade I diastolic dysfunction in 29% of patients, grade II diastolic dysfunction in 8% of patients, and grade III diastolic dysfunction in 2% of patients. (19)

In our study, there was no statistically significant association between grades of diastolic dysfunction and CD4 counts. Jain N et al also observed no statistically significant association between grades of diastolic dysfunction and CD4 counts. (19) Mankwe et al observed a statistically significant association between grades of diastolic

dysfunction and CD4 counts. (18) Further studies with a larger sample size are required to establish an association with CD4 count.

Table 1:- Distribution of study subjects according to demographic characteristics.

Demographic characteristics	Frequency	Percentage
Age(years)		
≤19	3	3%
20-29	16	16%
30-39	25	25%
40-49	30	30%
50-59	19	19%
≥60	7	7%
Mean ± SD	40.86 ± 11.9	
Gender		
Female	53	53%
Male	47	47%
Smokers	2	2%
Alcoholic	2	2%
ART regimen		
Tenofovir based regimen	67	67%
TLE	60	60%
TL LPV/R	3	3%
TL NVP	2	2%
TL ATV/R	2	2%
Zidovudine based regimen	33	33%
ZLN	30	30%
ZL EFV	2	2%
ZL ATV/R	1	1%
Duration of ART (years)		
≤5	29	29%
6-10	57	57%
>10	14	14%
Mean ± SD	7.29 ± 3.17	
Body mass index(kg/m²)		
Mean ± SD	21.05 ± 2.61	

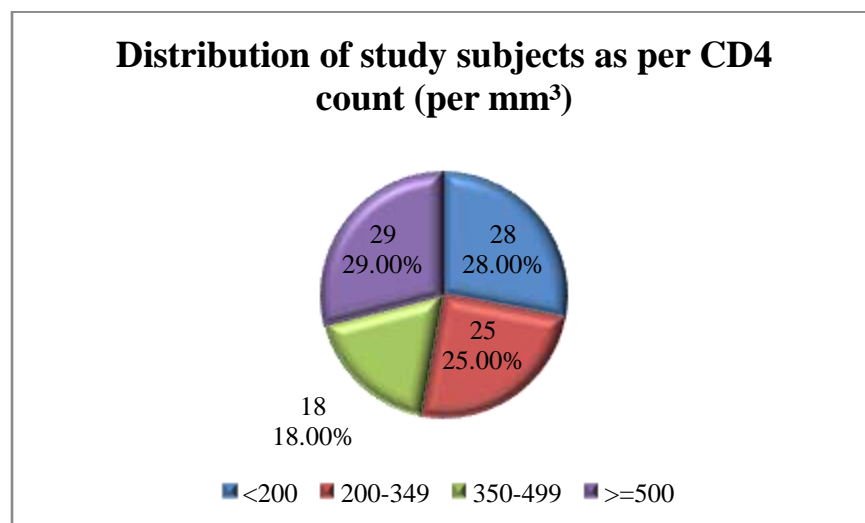


Figure 1:- Distribution of study subjects as per CD4 count (per mm³).

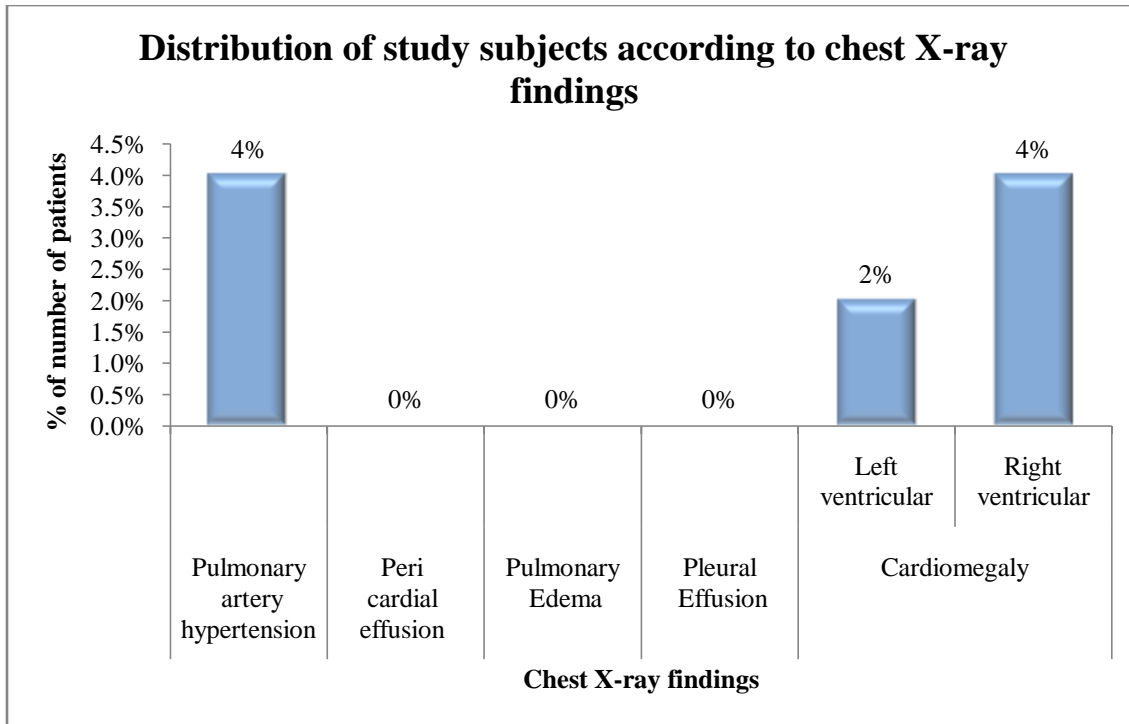


Figure 2:- Distribution of study subjects according to chest X-ray findings.

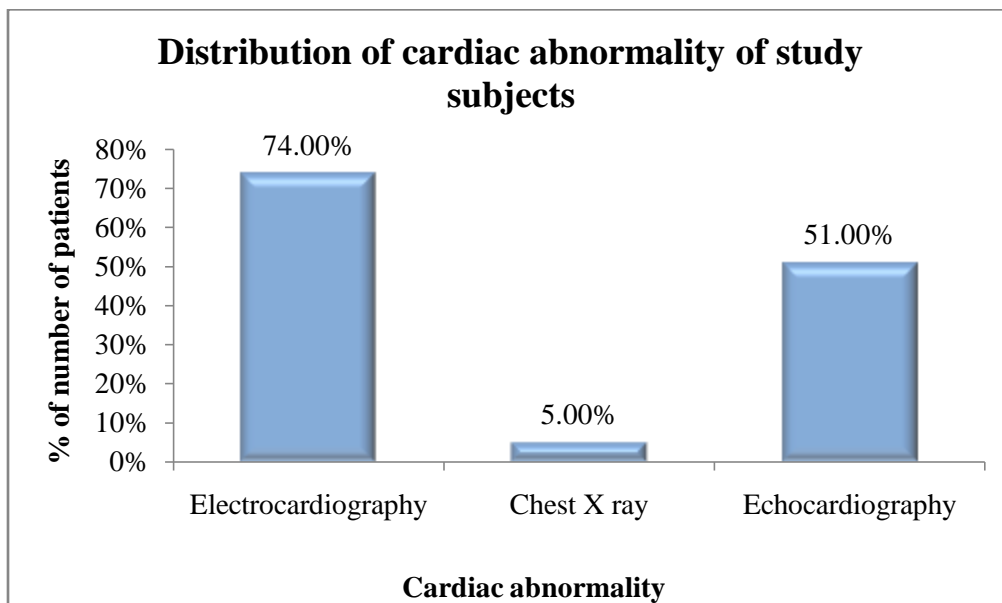


Figure 3:- Distribution of cardiac abnormality of study subjects.

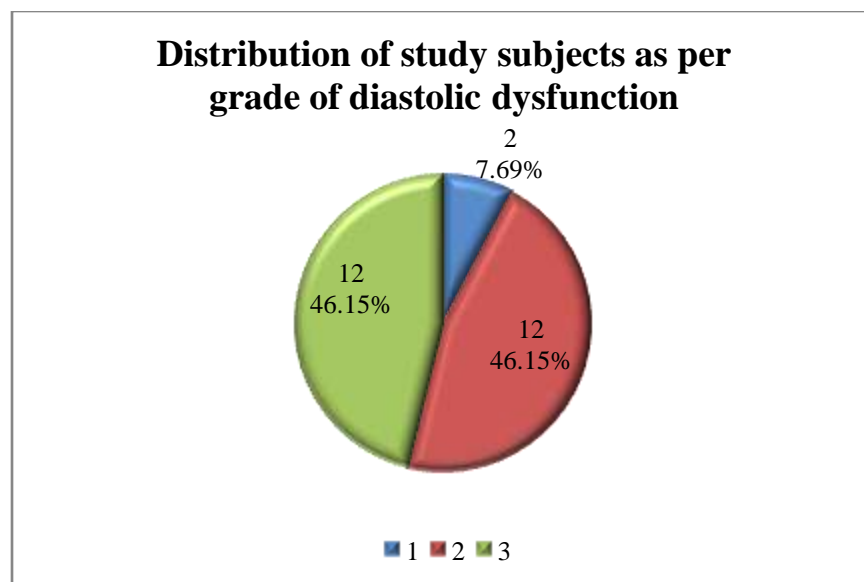


Figure 4:- Distribution of study subjects as per grade of diastolic dysfunction.

Table 2:- Association of echocardiographic and electrocardiographic abnormalities with CD4 count (per mm³).

Cardiac manifestations	<200 (n=28)	200-349 (n=25)	350-499 (n=18)	>=500 (n=29)	Total	P value	Test performed
Echocardiographic abnormalities							
Dilated cardiomyopathy	2 (7.14%)	2 (8%)	1 (5.56%)	1 (3.45%)	6 (6%)	0.891	Fisher Exact test
Left ventricular systolic dysfunction							
LVEF <50%	14 (50%)	2 (8%)	3 (16.67%)	8 (27.59%)	27 (27%)	0.004	Chi square test,13.074
Fractional shortening ≤25%	14 (50%)	5 (20%)	5 (27.78%)	10 (34.48%)	34 (34%)	0.128	Chi square test,5.691
Left ventricular diastolic function	15 (53.57%)	5 (20%)	4 (22.22%)	2 (6.90%)	26 (26%)	0.0007	Chi square test,17.165
Pericardial effusion	0 (0%)	0 (0%)	1 (5.56%)	0 (0%)	1 (1%)	0.18	Fisher Exact test
Regional wall motion abnormality	1 (3.57%)	1 (4%)	0 (0%)	0 (0%)	2 (2%)	0.689	Fisher Exact test
Pulmonary hypertension	3 (10.71%)	0 (0%)	1 (5.56%)	0 (0%)	4 (4%)	0.084	Fisher Exact test
Infective endocarditis	0 (0%)	0 (0%)	1 (5.56%)	0 (0%)	1 (1%)	0.18	Fisher Exact test
Overall cardiac abnormality	23 (82.14%)	8 (32%)	7 (38.89%)	13 (44.83%)	51 (51%)	0.001	Chi square test,15.977
ECG Abnormalities							
Sinus tachycardia	5 (17.86%)	5 (20%)	6 (33.33%)	4 (13.79%)	20 (20%)	0.427	Chi square test,2.779
Sinus bradycardia	0 (0%)	1 (4%)	1 (5.56%)	0 (0%)	2 (2%)	0.341	Fisher Exact test
PR interval shortening	0 (0.00%)	0 (0.00%)	1 (5.56%)	1 (3.45%)	2 (2.00%)	0.548	Fisher Exact test
Low voltage complexes	0 (0%)	2 (8%)	1 (5.56%)	3 (10.34%)	6 (6%)	0.386	Fisher Exact test
Left axis deviation	10	3 (12%)	4 (22.22%)	4 (13.79%)	21 (21%)	0.122	Chi square

	(35.71%)						test,5.799
Right axis deviation	4 (14.29%)	1 (4%)	1 (5.56%)	0 (0%)	6 (6%)	0.139	Fisher Exact test
RBBB	1 (3.57%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0.71	Fisher Exact test
LBBB	3 (10.71%)	0 (0%)	0 (0%)	0 (0%)	3 (3%)	0.04	Fisher Exact test
T inversion	6 (21.43%)	7 (28%)	4 (22.22%)	12 (41.38%)	29 (29%)	0.341	Chi square test,3.352
Poor progression of r wave	4 (14.29%)	3 (12%)	3 (16.67%)	1 (3.45%)	11 (11%)	0.41	Fisher Exact test
QTc prolongation	15 (53.57%)	9 (36%)	6 (33.33%)	5 (17.24%)	35 (35%)	0.04	Chi square test,8.298

Table 3:- Association of echocardiographic and electrocardiographic abnormalities with the type of ART regimen.

Cardiac manifestations	Tenofvir based regimen (n=67)	Zidovudine based regimen (n=33)	Total	P value	Test performed
Echocardiographic abnormalities					
Dilated cardiomyopathy	4 (5.97%)	2 (6.06%)	6 (6%)	1	Fisher Exact test
Left ventricular systolic dysfunction					
LVEF <50%	16 (23.88%)	11 (33.33%)	27 (27%)	0.317	Chi square test,1.002
Fractional shortening ≤25%	21 (31.34%)	13 (39.39%)	34 (34%)	0.424	Chi square test,0.639
Left ventricular diastolic function	15 (22.39%)	11 (33.33%)	26 (26%)	0.241	Chi square test,1.377
Pericardial effusion	1 (1.49%)	0 (0%)	1 (1%)	1	Fisher Exact test
Regional wall motion abnormality	1 (1.49%)	1 (3.03%)	2 (2%)	1	Fisher Exact test
Pulmonary hypertension	3 (4.48%)	1 (3.03%)	4 (4%)	1	Fisher Exact test
Infective endocarditis	1 (1.49%)	0 (0%)	1 (1%)	1	Fisher Exact test
Overall cardiac abnormality	32 (47.76%)	19 (57.58%)	51 (51%)	0.356	Chi square test,0.852
ECG abnormalities					
Sinus tachycardia	11 (16.42%)	9 (27.27%)	20 (20%)	0.202	Chi square test,1.628
Sinus bradycardia	2 (2.99%)	0 (0%)	2 (2%)	1	Fisher Exact test
PR interval prolongation	0 (0%)	0 (0%)	0 (0%)	No p value	-
PR interval shortening	42 (62.69%)	21 (63.64%)	63 (63%)	0.926	Chi square test,0.009
Low voltage complexes	5 (7.46%)	1 (3.03%)	6 (6%)	0.661	Fisher Exact test
Left axis deviation	11 (16.42%)	10 (30.30%)	21 (21%)	0.109	Chi square test,2.569
Right axis deviation	5 (7.46%)	1 (3.03%)	6 (6%)	0.661	Fisher Exact test
RBBB	1 (1.49%)	0 (0%)	1 (1%)	1	Fisher Exact test

LBBB	2 (2.99%)	1 (3.03%)	3 (3%)	1	Fisher Exact test
T inversion	15 (22.39%)	14 (42.42%)	29 (29%)	0.038	Chi square test,4.311
Poor progression of r wave	7 (10.45%)	4 (12.12%)	11 (11%)	1	Fisher Exact test
QTc prolongation	18 (26.87%)	17 (51.52%)	35 (35%)	0.015	Chi square test,5.905

Table 4:- Association of the grade of diastolic dysfunction with CD4 count (per mm³).

Grade of diastolic dysfunction	<200 (n=15)	200-349 (n=5)	350-499 (n=4)	≥500 (n=2)	Total	P value	Test performed
1	1 (6.67%)	1 (20%)	0 (0%)	0 (0%)	2 (7.69%)	0.094	Fisher Exact test
2	5 (33.33%)	1 (20%)	4 (100%)	2 (100%)	12 (46.15%)		
3	9 (60%)	3 (60%)	0 (0%)	0 (0%)	12 (46.15%)		
Total	15 (100%)	5 (100%)	4 (100%)	2 (100%)	26 (100%)		

Left Ventricular Systolic Dysfunction

In our study, we observed reduced fractional shortening ($\leq 25\%$) in 34% of patients and reduced left ventricular ejection fraction ($< 50\%$) in 27% of patients. Maurya SK et al observed similar findings as our study with reduced fractional shortening in 35% of patients and reduced ejection fraction in 22% of patients. (16)

We observed a statistically significant association between reduced left ventricular ejection fraction (LVEF $< 50\%$) and CD4 count less than 200/mm³, while the association between reduced fractional shortening and CD4 count was not statistically significant. Similarly, Mishra TK et al observed a statistically significant association between reduced ejection fraction and CD4 count less than 200/mm³. He also observed a statistically significant association between reduced fractional shortening and CD4 count less than 200/mm³. (14) Sharma RK also observed a statistically significant association of reduced ejection fraction and reduced fractional shortening with CD4 count less than 200/mm³. (8)

Dilated Cardiomyopathy

In our study, dilated cardiomyopathy was present in 6% of patients. Sharma RK et al reported dilated cardiomyopathy in 9.25% of patients. (8) While Singh A et al observed dilated cardiomyopathy in 8.5% of patients, Mishra TK et al observed it in as much as 24% of patients. (14,20)

There was no statistically significant association between dilated cardiomyopathy and CD4 count. Mishra TK et al also found no statistically significant association between dilated cardiomyopathy and CD4 count. (14)

Pulmonary Hypertension

Pulmonary hypertension was present in 4% of patients in our study. Tuteja V et al and Sharma RK et al observed pulmonary hypertension in 10% and 11.11% of patients respectively. (8,17) There was no statistically significant association between pulmonary hypertension and CD4 count in our study. Mishra TK et al and Tuteja V et al also did not find any statistically significant association between pulmonary hypertension and CD4 count. (14,17)

Regional Wall Motion Abnormalities

In our study, regional wall motion abnormalities were present in only 2% of patients. One of 2 patients had hypokinesia in the anterior, anteroseptal, and anterolateral wall another patient had a hypokinetic inferior wall. In a study published by Sharma RK et al, only one patient had regional wall motion abnormality in the anterior wall. (8) Mishra TK et al found regional wall motion abnormality in 2 patients (1%). (14) We did not find a statistically significant association between regional wall motion abnormality and CD4 count.

Pericardial Effusion

Pericardial effusion was present in only one patient (1%) in our study. Most other studies reported pericardial effusion in 7% to 28% of patients. Pericardial effusion in HIV-infected patients is most commonly due to opportunistic infection. As patients included in our study were receiving ART and were well complied with the drug regimen, the incidence of opportunistic infection is likely to be less. Hence the only one patient had pericardial effusion in our study. A study published by Mishra TK et al and our study did not find any association between pericardial effusion and CD4 count. (14)

Infective Endocarditis

We found infective endocarditis in only one patient (1%) in our study. A review of autopsy studies and case reports published by Currie et al estimated infective endocarditis in 3-5% of patients with HIV infection. Smith et al in their study observed a relatively high incidence of infective endocarditis (11.5%) in HIV-infected patients. (21) While most studies reported infective endocarditis exclusively in intravenous drug users, patients in our study with infective endocarditis denied any intravenous drug use. (22,23) Very few cases of infective endocarditis had been reported involving the left side of the heart. (24,25) Patients in our study had vegetations on the mitral valve, aortic valve, and tricuspid valve.

Other cardiovascular abnormalities such as cardiac neoplasms have also been described in various studies. Due to the limited sample size, we could not find any patient with cardiac mass/ neoplasm on echocardiographic examination.

Lewis et al in their study implicated Zidovudine (AZT) in skeletal muscle myopathies and demonstrated that cultured cardiac muscle cells treated with AZT develop mitochondrial abnormalities, suggesting that AZT-treated patients may experience cardiac muscle myopathies. (26) We compared the association of cardiac abnormalities with ART regimen based on Zidovudine and ART regimen based on Tenofovir. Overall echocardiographic abnormality was present in 57.58% of patients on the Zidovudine-based ART regimen and 47.76% of patients on the Tenofovir-based ART regimen. Dilated cardiomyopathy was present in 6.06% of patients on the Zidovudine-based ART regimen and 5.97% of patients on the Tenofovir-based regimen. There was no statistically significant association between echocardiographic abnormalities and the type of ART regimen. QTc prolongation and T inversion were observed in a higher number of patients on the Zidovudine-based regimen compared to the Tenofovir-based regimen and this difference was statistically significant. Further, follow-up echocardiographic studies are required to estimate the incidence of cardiomyopathy in patients on the zidovudine-based regimen.

Though the cardiac abnormalities were more common in patients who received ART for more than 10 years, no statistically significant association was observed between echocardiographic and electrocardiographic abnormalities and the duration of ART. Our study examined the patient at a single point in time. We recommend a prospective observational study for better evaluation of the effect of duration of ART on cardiovascular complications.

Conclusion:-

Cardiovascular complications are commonly seen in HIV-infected patients. As the epidemic progresses and new treatments help increase the long-term survival of affected individuals, cardiovascular complications will become more common.

The present study was aimed at estimating the prevalence of cardiac abnormalities in HIV-positive patients and also to find out its correlation with CD4 count and ART regimen. In the present study electrocardiographic, chest X-ray, and echocardiographic abnormalities were present in 74%, 10%, and 51% of patients respectively.

The determination of Incidence and Prevalence of cardiac abnormalities in HIV-infected individuals using non-invasive tests is quite feasible and should be done in all patients visiting in ART center.

Cardiac abnormalities were observed in HIV-positive patients regardless of symptoms. Hence all HIV-positive patients irrespective of their symptoms should be evaluated for cardiac complications.

Cardiac abnormalities such as QTc prolongation, LBBB, reduced left ventricular ejection fraction, and left ventricular diastolic dysfunction were more significantly higher in patients with CD4 count less than 200/mm³.

Hence regular CD4 count testing of HIV-positive patients should be done so that early intervention in patients with low CD4 count can be done. Compliance with and resistance to ART regimen should be checked.

Strategies to prevent cardiovascular disease in HIV-infected patients should focus on reducing traditional risk factors, as well as HIV and ART-specific risk factors.

Early recognition and prompt treatment are important to prevent significant morbidity from cardiac involvement. Whether this approach will prolong survival in AIDS patients remains to be seen.

Recommendations:-

A baseline ECG, chest X-ray, and echocardiographic study should be done for all patients with HIV infection at the first visit to be done. A prospective observational study should be done to evaluate the natural history of cardiac complications in HIV patients and also to evaluate the effect of a longer duration of ART and its side effects on cardiac complications.

Bibliography:-

1. Unaid. Unaid. Joint United Nations Programme on HIV/AIDS. Unaid data 2020. Geneva, Switzerland. Unaid [Internet]. 2020. Available from: https://www.unaids.org/sites/default/files/media_asset/2020_aids-data-book_en.pdf
2. UNAIDS. UNAIDS Data 2018. 2018.
3. Boccara F. Cardiovascular health in an aging HIV population. AIDS. 2017;
4. Kaul S, Fishbein MC, Siegel RJ. Cardiac manifestations of acquired immune deficiency syndrome: A 1991 update. Am Heart J. 1991;
5. Singh S, Vatsa D, Tomar S, Aneja G, S. Arya T. Cardiac complications in people living with human immunodeficiency virus/acquired immunodeficiency syndrome and their association with CD4+ T-cell count – A cross sectional study. Indian J Sex Transm Dis AIDS. 2018;39(1):23.
6. Pinamonti B, Abate E, De Luca A, Finocchiaro G, Korcova R. Role of Cardiac Imaging: Echocardiography. In: Sinagra G, Merlo M, Pinamonti B, editors. Dilated Cardiomyopathy: From Genetics to Clinical Management [Internet]. Cham: Springer International Publishing; 2019. p. 83–111. Available from: https://doi.org/10.1007/978-3-030-13864-6_7
7. Nagueh SF, Appleton CP, Gillebert TC, Marino PN, Oh JK, Smiseth OA, et al. Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography. J Am Soc Echocardiogr. 2009;
8. Sharma RK, Chavan V, Neki NS, Singh AP, Jaitwani J, Kumar H, et al. Study of Cardiac Manifestations in Patients with HIV Infection and Their Correlation with CD4 Count in Indian Population. Ann Int Med Dent Res. 2016;3(1):4–11.
9. Kumar P, Sahu D, Chandra N, Kumar A, Rajan S. Aging of HIV epidemic in India: Insights from HIV estimation modeling under the national aids control programme. Indian J Public Health. 2020;64:S76–8.
10. Bajaj S, Mol T, Saxena P, Yadav R, Verma S. Study of cardiovascular manifestations in patients of HIV- its correlation with CD4 count and the ART regimen prescribed. Int J Adv Med. 2016;3(2):382–7.
11. R B SS, K V, Gunasekaran K, J D. a Study of the Cardiac Manifestations in Hiv Positive Individuals and Its Correlation With Disease Severity and Framingham Risk Score. J Evid Based Med Healthc. 2015;2(34):5211–9.
12. Chaudhary S, Apurva, Sawlani KK, Himanshu Reddy D, Yadav SC, Patel ML, et al. A study of cardiovascular abnormalities in HIV positive patients in a tertiary care hospital in Northern India. J Assoc Physicians India. 2017;65:24–9.
13. Okoye IC, Anyabolu EN. Electrocardiographic abnormalities in treatment-naïve HIV subjects in south-east Nigeria. Cardiovasc J Afr. 2017;28:315–8.
14. Mishra TK, Mishra SK, Singh S. Cardiovascular manifestations of people living with HIV/AIDS: Report from a hot spot in eastern India. Indian Heart J [Internet]. 2019;71(4):338–43. Available from: <https://doi.org/10.1016/j.ihj.2019.09.006>
15. K. S, B. J, R. B. A study of clinical profile of cardiac dysfunction in patients with HIV infection. Int J Res Med Sci. 2016;4(12):5149–53.
16. Saxena P. Cardiac manifestations in HIV patients and their correlation with CD4 count. J Med Sci Clin Res. 2020;08(02):783–7.
17. Tuteja V, Nawal C, Meena C, Singh A, Chejara R, Singh R, et al. A study of cardiac dysfunction in human

- immunodeficiency virus-infected patients and its correlation with cd4 count. *J Clin Prev Cardiol.* 2019;8:156–60.
18. Chesa Mankwe A, James Odia O. Association between CD4+ Lymphocyte Count and Left Ventricular Diastolic Function and Geometry in Newly Diagnosed Highly Active Antiretroviral Therapy (HAART) Naive HIV/AIDS Patients Seen at University of Port Harcourt Teaching Hospital, Port Harcourt, Ri. *J Cardiovasc Dis Diagnosis.* 2017;05(05).
 19. Jain N, Reddy DH, Verma SP, Khanna R, Vaish AK, Usman K, et al. Cardiac abnormalities in HIV-positive patients: Results from an observational study in India. *J Int Assoc Provid AIDS Care.* 2014;
 20. Singh A, Das S, Kumar Dalai R. Study of Cardiac Manifestations in Patients with HIV Infection and Their Correlation with CD4 Count in Indian Population. *Int J Clin Med.* 2012;03(03):178–83.
 21. Smith DT, Sherwood M, Crisel R, Abraham J, Mansour C, Veledar E, et al. A comparison of HIV-positive patients with and without infective endocarditis: An echocardiographic study - The Emory endocarditis group experience. *Am J Med Sci.* 2004;328(3):145–9.
 22. Cicalini S, Forcina G, De Rosa FG. Infective endocarditis in patients with human immunodeficiency virus infection. *J Infect.* 2001;
 23. Currie PF, Sutherland GR, Jacob AJ, Bell JE, Brettle RP, Boon NA. A review of endocarditis in acquired immunodeficiency syndrome and human immunodeficiency virus infection. *Eur Heart J.* 1995;16(SUPPL. B):15–8.
 24. Melinyte K, Savickaite J, Rekiene DE, Naudžiunas A, Burkauskiene A, Jankauskiene L. Infective endocarditis in an HIV-infected intravenous drug user. *Rev Port Cardiol.* 2015;
 25. Losa JE, Miro JM, Del Rio A, Moreno-Camacho A, Garcia F, Claramonte X, et al. Infective endocarditis not related to intravenous drug abuse in HIV-1-infected patients: Report of eight cases and review of the literature. *Clin Microbiol Infect* [Internet]. 2003;9(1):45–54. Available from: <http://dx.doi.org/10.1046/j.1469-0691.2003.00505.x>
 26. Lewis W, Kohler JJ, Hosseini SH, Haase CP, Copeland WC, Bienstock RJ, et al. Antiretroviral nucleosides, deoxynucleotide carrier and mitochondrial DNA: Evidence supporting the DNA pol γ hypothesis. *Aids.* 2006;20(5):675–84.